What is Claimed is:

1. A method for depositing a catalytic layer on a surface of a substrate, the method comprising

   in an upstream region of a fluid stream, providing particulates comprising a catalytic material,

   in a downstream region of said fluid stream, providing a spray comprising polymeric material so as to mix said particulates with said polymeric material, and

   impinging said fluid stream on said substrate surface so as to co-deposit said particulates and said polymer on said substrate surface.
2. The method according to Claim 1 wherein said substrate is porous and wherein a vacuum is applied to said substrate opposite said surface on which said polymeric material and said particulates are co-deposited.
3. The method according to Claim 1 wherein said particulates comprise a conducting support material and a catalytic material on the surface of said conducting support material.
4. The method according to Claim 3 wherein said catalytic material and said support material are separately introduced to said upstream region and combined to form said particulates prior to introduction into said downstream region.
5. The method according to Claim 3 wherein said catalytic material is formed in said upstream region by combustion chemical vapor deposition.
6. The method according to Claim 3 wherein said support material is introduced into said upstream region as a dry powder.
7. The method according to Claim 5 wherein a spray of quench liquid is introduced into said upstream region.

8. Apparatus for depositing a catalytic material on a substrate, said apparatus comprising

gas flow means for directing a stream of gas through an upstream region, a downstream region, and a deposition region,

means for locating a substrate in said deposition region such that the stream of gas impinges on a surface of said substrate,

means at said upstream region for introducing particulates comprising a catalytic material, and

means at said downstream region for introducing a fluid comprising a polymer in finely divided form such that said particulates mix with said polymer,

whereby said gas stream carries a mixture of particulates and polymer to said substrate surface.

9. Two or more apparatuses according to claim 8, a first for depositing material of one composition on a substrate, and a second for subsequently depositing material of a second composition.

10. Apparatus according to Claim 8 wherein comprising vacuum means for pulling said gas stream through a porous substrate and gas-stream-entrained material into pores of the porous substrate.

11. A method of depositing on a substrate surface a layer containing both hydrating and proton conducting material and having sufficiently low porosity to not allow gas flow into said layer, the method comprising,

providing a solution/slurry comprising particulates of a hydrating or proton conducting material in a carrier liquid,

atomizing said solution/slurry to produce particulates of said solution/slurry,

directing said solution/slurry particulates at said substrate surface, and

prior to reaching said substrate surface, removing a sufficient amount of said carrier liquid from said solution/slurry particulates such that said solution/slurry particulates agglomerate on said substrate surface and coalesce, but do not liquid flow in the layer that is formed.

12. The method according to Claim 11 wherein said solution/slurry particulates are introduced into, dried, and directed at said substrate surface through an enclosed region.
13. The method according to Claim 11 wherein a second material is introduced separately from the said solution/slurry.
14. The method according to Claim 13 wherein said substrate is porous.
15. A method of producing a porous layer of solid material on a surface of a porous substrate comprising

providing a flow of gases directed to said substrate surface,

providing a solution and/or slurry of said solid material in a carrier liquid,

atomizing said solution and/or slurry in said gas stream to produce particulates of said solution and/or slurry,

prior to reaching said substrate surface, removing a sufficient amount of said carrier liquid from said solution/slurry particulates such that said solution and/or slurry particulates agglomerate on said substrate surface but do not fully coalesce, but leave pores in the layer of solid material that is formed, and

providing a vacuum behind said substrate to draw said particulates to said substrate surface.

16. A method for depositing a catalytic layer on a surface of a substrate, the method comprising:

in an upstream region of a fluid stream, providing particulates comprising a catalytic material supported by a conductive material,

in a downstream region of said fluid stream, providing a spray comprising polymeric material so as to mix said particulates with said polymeric material, and

impinging said fluid stream on said substrate surface so as to co-deposit said particulates and said polymer on said substrate surface.

17. Apparatus for depositing a layer of catalytic material between a web of porous material and a web of proton exchange membrane comprising,

means at an upstream location for conveying said web of protein exchange membrane and said web of porous material in parallel spaced-apart relationship,

means at a downstream location for nipping said membrane and said web together, and

means for directing catalytic material between said web and said membrane at upstream location to deposit catalytic material on said web and said membrane prior to said downstream location.

18. Apparatus according to Claim 17 further comprising fluid dam means for defining a confined deposition region between said membrane and said web.

19. An electrocatalytic layer comprising in combination,

a gas permeable substrate having regions of greater gas permeability and regions of lesser gas permeability, and

material comprising a catalyst deposited on said substrate such that said combination has a higher catalyst loadings in regions of higher gas permeability than in regions of lower catalytic loading.

20. The electrocatalytic layer according to Claim 19 wherein a maximum catalyst loading, as located in regions of higher gas permability, in a through-the-layer direction, is at least 10% greater than an average catalyst loading.

21. An electrocatalytic or gas diffusion layer comprising in combination,

a gas permeable substrate having regions of greater gas permeability and regions of lesser gas permeability,

a first material of a first composition deposited as a first permeable layer on said substrate, said first material layer functioning to equalize gas permeability across said combination, and

a second material of a second composition deposited on said first layer.

22. The electrocatalytic or gas diffusion layer of Claim 21 wherein said first composition comprises no catalyst or a relatively low concentration of a catalyst and said second composition comprises a relatively high concentration of said catalyst.
23. The electrocatalytic or gas diffusion layer of Claim 21 further comprising a gas-permeable substrate, the gas permeability of said electrocatalytic or gas diffusion layer varying by 50% or less between predominately any 10,000 micron^2 area and any other 10,000 micron^2 area.
24. A proton-conducting membrane for a fuel cell comprising proton-transfer material intimately admixed with an amount of a water-binding material effective to allow continued operation of a fuel cell at temperatures above 100°C.
25. The proton-conducting membrane of Claim 24 wherein said water-binding material is in amounts effective to allow continued operation of a fuel cell at temperatures of about 150°C or above.
26. The proton-conducting membrane of Claim 24 wherein said water-binding material is in amounts effective to allow continued operation of a fuel cell at temperatures of about 200°C or above.
27. A proton-conducting membrane for a hydrogen/oxygen fuel cell comprising a proton-transfer material plus a catalytic material for converging oxygen and hydrogen that diffuse into said proton-conducting membrane to water.
28. The proton-conducting membrane of Claim 27 wherein said catalytic material comprises a discrete film or layer between layers of proton-transfer material.
29. The proton-conducting membrane of Claim 27 wherein said catalytic material comprises platinum.
30. The proton-conducting membrane of Claim 27 wherein said proton-transfer material contains water-binding material.
31. A proton-conducting membrane for a methanol/oxygen fuel cell comprising a layer of methanol-blocking material between layers of proton-transfer material.

32. The proton-conducting membrane of Claim 31 wherein said methanol-blocking material comprises zirconium phosphate.
33. The proton-conducting membrane of Claim 31 wherein said proton-transfer material contains water-binding material.